OCTAVE NOTEBOOK

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#### Commands
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x = 3
y = x + 1
clc # does nothing in script?
clear x
y
6*10/13+18/(5*7)+5*9^2
```
```

```
6*(35^(1/4))+14^0.35
6*(35^(1/4));
x = [-1:0.5...
:0.51]
quit
```
Output
```matlab
x = 3
y = 4
y = 4
ans = 410.13
ans = 17.112
x =

  -1.0000  -0.5000        0   0.5000
```

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SYLLABUS

This browser does not support PDFs. Please download the PDF to view it: tweoss.github.io/octave/assets/Engineering_60_Notebook_Syllabus.pdf.

LAB 1

General Commands

Commands

```
x = 3
y = x + 1
clc # does nothing in script?
clear x
y
6*10/13+18/(5*7)+5*9^2
6*(35^(1/4))+14^0.35
6*(35^(1/4));
x = [-1:0.5...
:0.51]
quit
```

Output

```
x = 3
y = 4
y = 4
ans = 410.13
ans = 17.112
x =

  -1.0000  -0.5000        0   0.5000
```

LAB 2

Variables

Commands

```
r = 8;
h = 15;
V = pi * r ^ 2 * h;
V = V + 0.2 * V;
r = sqrt(V/(pi*h))
```

Output

```
r = 8.7636
```

Complex Numbers

Commands

```
x = -5 + 9i;
y = 6 - 2i;
whos
x + y
x*y
x/y
```

Output

```
Variables visible from the current scope:

variables in scope: top scope

   Attr Name        Size                     Bytes  Class
   ==== ====        ====                     =====  =====
   c    x           1x1                         16  double
   c    y           1x1                         16  double

Total is 2 elements using 32 bytes

ans =  1 + 7i
ans = -12 + 64i
ans = -1.2000 + 1.1000i
```

Arrays

Commands

```
u = [0: 0.1 :10];
w = 5 * sin(u);
u(7)
w(7)
m = length(w)
v = cos(0): 0.02 :log10(100);
length(v)
v(25)
```

Output

```
ans = 0.6000
ans = 2.8232
m = 101
ans = 51
ans = 1.4800
```

Polynomial Roots

Commands

```
a = [1,-7,40,-34];
roots(a)
```

Output

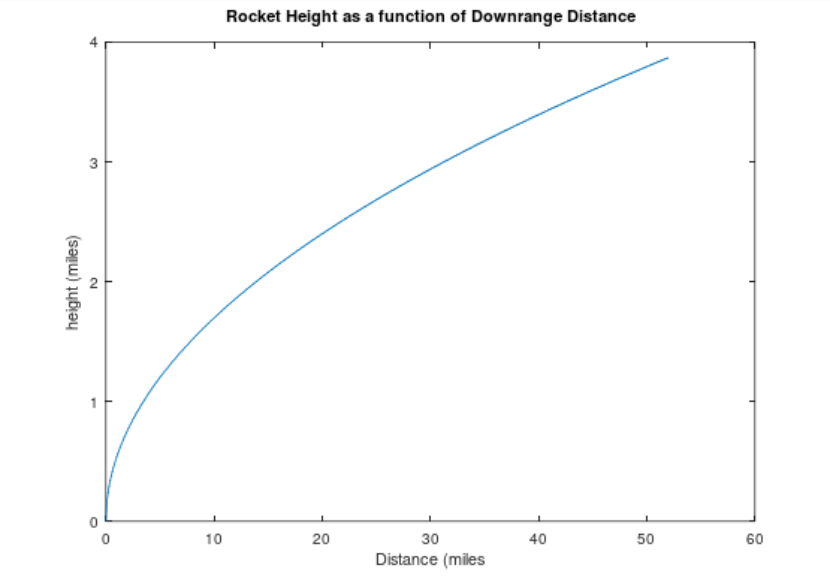
```
ans =

   3.0000 + 5.0000i
   3.0000 - 5.0000i
   1.0000 +      0i
```

Plotting

Commands

```
x = [0:0.1:52];
y = 0.4*sqrt(1.8*x);
plot(x,y),xlabel('Distance (miles'),ylabel('height (miles)'),...
title('Rocket Height as a function of Downrange Distance')
pause
```

Output



Examples

Square Root

Commands

```
x = [1:10];
y = sqrt(x)
```

Output

```
y =
```

```
 Columns 1 through 8:

   1.0000   1.4142   1.7321   2.0000   2.2361   2.4495   2.6458   2.8284

 Columns 9 and 10:

   3.0000   3.1623
```

Population Table

Commands

```
yr = [1984 1986 1988 1990 1992 1994 1996];
pop = [127 130 136 145 158 178 211];
tableYP(:,1) = yr';
tableYP(:,2) = pop';
disp('')
disp('   YEAR    POPULATION')
disp('           (MILLIONS)')
disp('')
disp(tableYP)
disp('')
```

Output

```
   YEAR    POPULATION
         (MILLIONS)

   1984    127
   1986    130
   1988    136
   1990    145
   1992    158
   1994    178
   1996    211
```

Average per Game

Commands

```
number1 = input('Enter the points scored in the first game: ');
if number1 < 0
   disp('Warning! Input Invalid. Using absolute value.')
   number1 *= -1;
end
number2 = input('Enter the points scored in the second game: ');
if number2 < 0
   disp('Warning! Input Invalid. Using absolute value.')
   number2 *= -1;
end
number3 = input('Enter the points scored in the third game: ');
if number3 < 0
   disp('Warning! Input Invalid. Using absolute value.')
```

```
   number3 *= -1;
end

disp('The average of points scored is ')
disp((number1 + number2 + number3)/3)
```

Output

```
Enter the points scored in the first game: -1
Warning! Input Invalid. Using absolute value.
Enter the points scored in the second game: 2
Enter the points scored in the third game: 0
The average of points scored is
1
```

Projectile Motion

Commands

```
speed = input('Speed: ');
gravity = -9.81;
startHeight = input('Starting Height: ');
angle = input('Starting Angle in Radians: ');
disp('');
angle
horizontalVelocity = speed * cos(angle)
verticalVelocity = speed * sin(angle)
timeInFlight = verticalVelocity/(abs(gravity/2))
horizontalVelocity = timeInFlight * horizontalVelocity
disp('');
```

Output

```
Speed: 50
Starting Height: 0
Starting Angle in Radians: pi/4

angle = 0.7854
horizontalVelocity = 35.355
verticalVelocity = 35.355
timeInFlight = 7.2080
horizontalVelocity = 254.84
```

LAB 3

Question 1

Enter your House Information here.

Enter your House Information here.			
Style	Condo	BD	2
County	Santa Clara, CA	TB	2
Sq. Feet	950	Acrq	0.0219

Question 2

15-Year Mortgage Loan Details	
Select a Bank Option:	Bank 1
Closing Costs Fees:	$1,400.00
Closing Costs Points:	1.0
Loan Interest Rate:	3.890%

30-Year Mortage Loan Details	
Select a Bank Option:	Bank 1
Closing Costs Fees:	$1,700.00
Closing Costs Points:	1.3
Loan Interest Rate:	4.59%

Question 3

House Listing Price	**$849,000.00**
Down Payment	$170,000.00
Closing Costs	$8,190.00
Total Loan Amount	$687,190.00
APR	3.89%
Loan Term (months)	180
Monthly Payment	$5,045.26
Total Payments	$908,147.57
Total Interest	$220,957.57

Question 4

House Listing Price	**$849,000.00**
Down Payment	$170,000.00
Closing Costs	$10,187.50
Total Loan Amount	$689,187.50

House Listing Price	$849,000.00
APR	4.59%
Loan Term (months)	360
Monthly Payment	$3,528.96
Total Payments	$1,270,426.79
Total Interest	$581,239.29

Question 5

15-year vs. 30-year Mortgage Comparison	
Which loan has the higher monthly payment?	15-year Mortgage
How much higher per month is the payment?	$1,516.30
Which loan has more total interest paid?	30-year Mortgage
How much more total interest is paid?	$360,281.71

Equity Comparison	
Suppose you sell your home at year 10 for $1018800. After you repay the remaining balance of your home, any money you have left over is called equity. The following questions help you compare the equity in your home after 10 years.	
15-year loan ending balance at year 10?	$274,692.95
30-year loan ending balance at year 10?	$553,547.39
15-year loan equity at year 10?	$744,107.05
30-year loan equity at year 10?	$465,252.61

Question 6

While the 15-year mortgage seems objectively better as I would have to pay less in the long term, if I were to purchase the house right now, I would be unable to pay the higher monthly payments. Instead of purchasing a house immediately, I could try to save money now and later take out a 15-year loan.

LAB 4

Exercises Pg 21

Commands

```
2^5/(2^5-1)
(1-1/2^5)^1
3*(sqrt(5)-1)/(sqrt(5)+1)^2-1
```

```
r = pi^(1/3)-1
pi*r^2

disp('')

exp(3)
log(exp(3))
log10(exp(3))
log10(10^5)
exp(pi*sqrt(163))
fsolve(@(x) [3^x-17],0)
log(17)/log(3)

disp('')

sin(pi/6)
cos(pi)
tan(pi/2)
sin(pi/6)^2 + cos(pi/6)^2
x = 32*pi;
y = cosh(x)^2-sinh(x)^2

disp('')

(1+3i)/(1-3i)
e^(i*pi/4)
cos(pi/4)+i*sin(pi/4)
exp(pi/2*i)
exp(pi/2i)
disp('pi/2i => pi/(2*i) != pi/2*i')
```

$$\frac{1+3i}{1-3i} = \frac{(1+3i)(1+3i)}{(1-3i)(1+3i)} = \frac{1+6i-9}{1-(-9)} = \frac{-8+6i}{10} = -0.8+.6i$$

Output

```
ans = 1.0323
ans = 0.9688
ans = -0.6459
r = 0.4646
ans = 0.6781

ans = 20.086
ans = 3
ans = 1.3029
ans = 5
ans = 2.6254e+17
ans = 2.5789
ans = 2.5789

ans = 0.5000
ans = -1
ans = 1.6331e+16
ans = 1
y = 0

ans = -0.8000 + 0.6000i
ans =  0.7071 + 0.7071i
```

```
ans =  0.7071 + 0.7071i
ans =  6.1232e-17 + 1.0000e+00i
ans =  6.1232e-17 - 1.0000e+00i
pi/2i => pi/(2*i) != pi/2*i
```

Exercises Pg 25

Commands

```
y = @(x) [0.5*x-2];
y(0), y(1.5), y(3), y(4), y(5), y(7), y(9), y(10)

disp('');

t = [1:10];
x = t.*sin(t)
y = (t-1)./(t+1)
z = sin(t.^2)./t.^2

disp('')

theta = [0; pi/4; pi/2; 3*pi/4; pi; 5*pi/4];
r = 2;
x = r*cos(theta)
y = r*sin(theta)
sqrt(x.^2 + y.^2)

disp('')

n = [0:10];
r = 0.5;
sum(r.^n)
1/(1-0.5)
n = [0:50];
sum(r.^n)
n = [0:100];
sum(r.^n)

disp('')

# no page 45 provided
v = 0:0.2:12;
M = [sin(v); cos(v)];
size(v), size(M)
M(1, 1:10)
M(2, 1:10)
```

Output

```
ans = -2
ans = -1.2500
ans = -0.5000
ans = 0
ans = 0.5000
ans = 1.5000
ans = 2.5000
```

```
ans = 3

x =

 Columns 1 through 8:

   0.8415   1.8186   0.4234  -3.0272  -4.7946  -1.6765   4.5989   7.9149

 Columns 9 and 10:

   3.7091  -5.4402

y =

 Columns 1 through 8:

      0   0.3333   0.5000   0.6000   0.6667   0.7143   0.7500   0.7778

 Columns 9 and 10:

   0.8000   0.8182

z =

 Columns 1 through 6:

   8.4147e-01  -1.8920e-01   4.5791e-02  -1.7994e-02  -5.2941e-03  -2.7549e-02

 Columns 7 through 10:

  -1.9464e-02   1.4375e-02  -7.7764e-03  -5.0637e-03


x =

   2.0000e+00
   1.4142e+00
   1.2246e-16
  -1.4142e+00
  -2.0000e+00
  -1.4142e+00

y =

      0
   1.4142
   2.0000
   1.4142
   0.0000
  -1.4142

ans =

   2
   2
   2
   2
   2
   2
```

```
ans = 1.9990
ans = 2
ans = 2.0000
ans = 2

ans =

   1   61

ans =

   2   61

ans =

 Columns 1 through 8:

      0   0.1987   0.3894   0.5646   0.7174   0.8415   0.9320   0.9854

 Columns 9 and 10:

   0.9996   0.9738

ans =

 Columns 1 through 7:

   1.000000   0.980067   0.921061   0.825336   0.696707   0.540302   0.362358

 Columns 8 through 10:

   0.169967  -0.029200  -0.227202
```

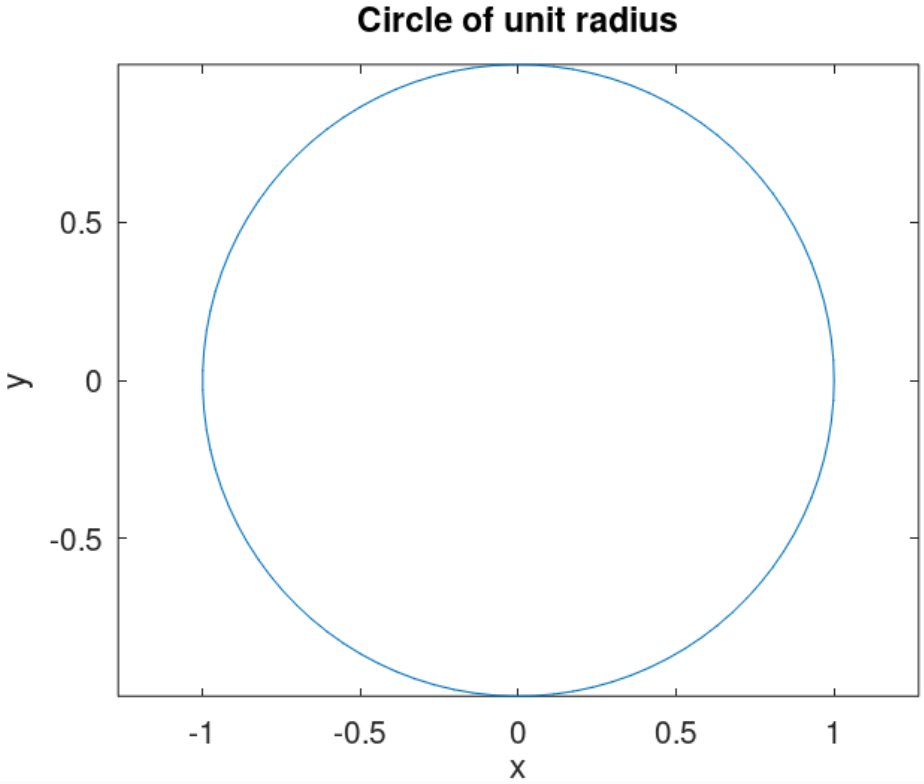
LAB 5

Pg 28 Plot Example

Commands

```
theta = linspace(0,2*pi,100);
x = cos(theta);
y = sin(theta);
plot(x,y)
axis('equal');
xlabel('x')
ylabel('y')
title('Circle of unit radius')
print # Did not make any action
pause; # So the program does not exit immediately.
```

Output



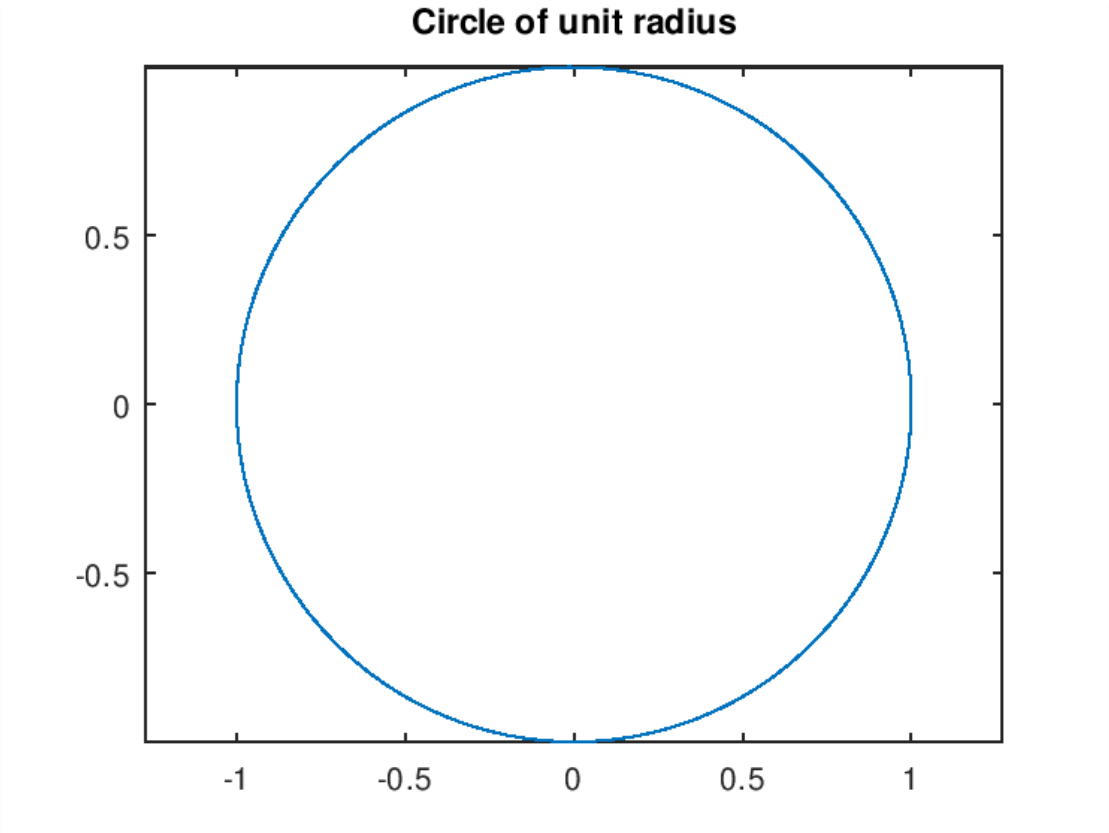
Pg 32 Explanation

Commands

```
% CIRCLE - A script file to draw a unit circle
% File written by Rudra Pratap. Last modified 6/28/98
% -------------------------
theta = linspace(0,2*pi,100);   % create vector theta
x = cos(theta);                                 % generate x-coordinates
y = sin(theta);                                 % generate y-coordinates
plot(x,y);
axis('equal');
title('Circle of unit radius')
```

Output

```
octave:1> help circle
'circle' is a script from the file /Users/francischua/gitprojects/octave/circle.m

 CIRCLE - A script file to draw a unit circle
 File written by Rudra Pratap. Last modified 6/28/98
 -------------------------
```



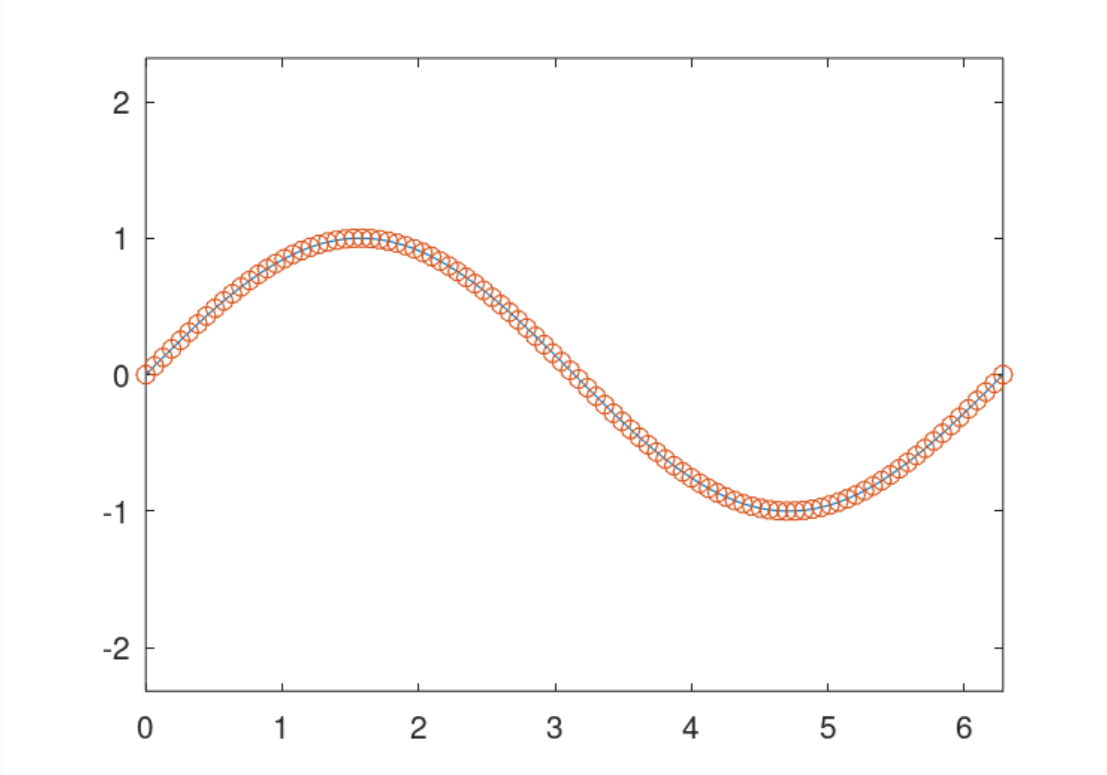
Pg 29 Exercise 2.3 Lesson 3

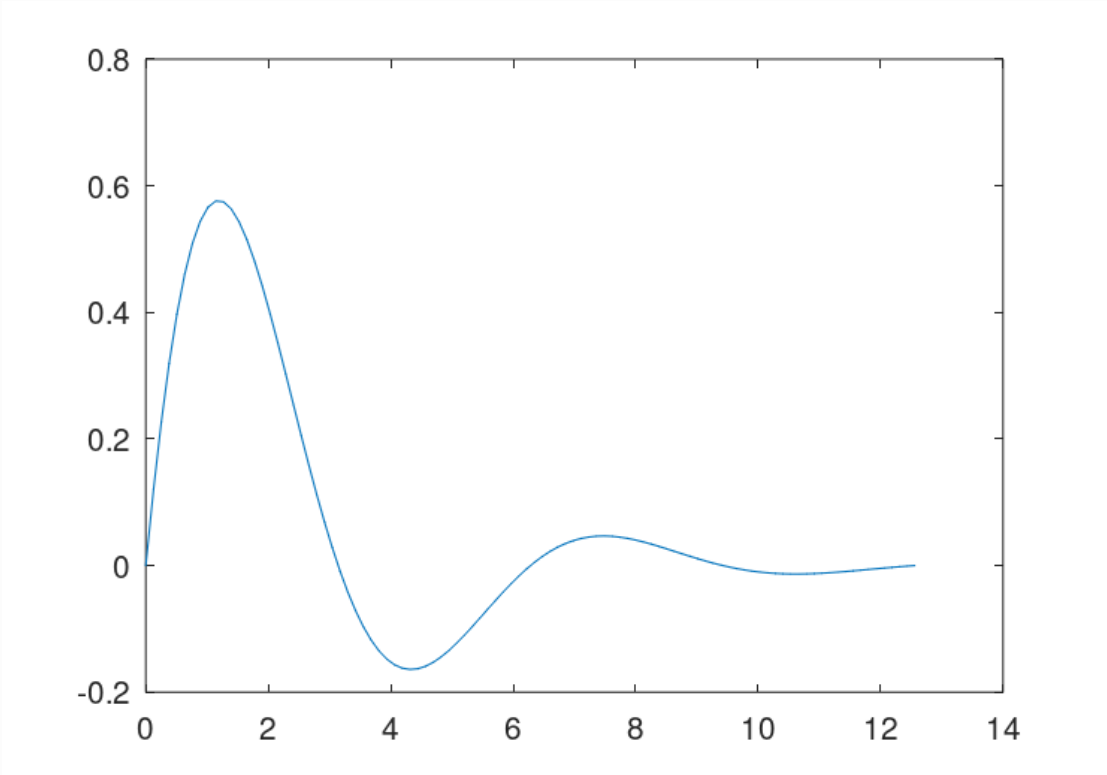
Commands

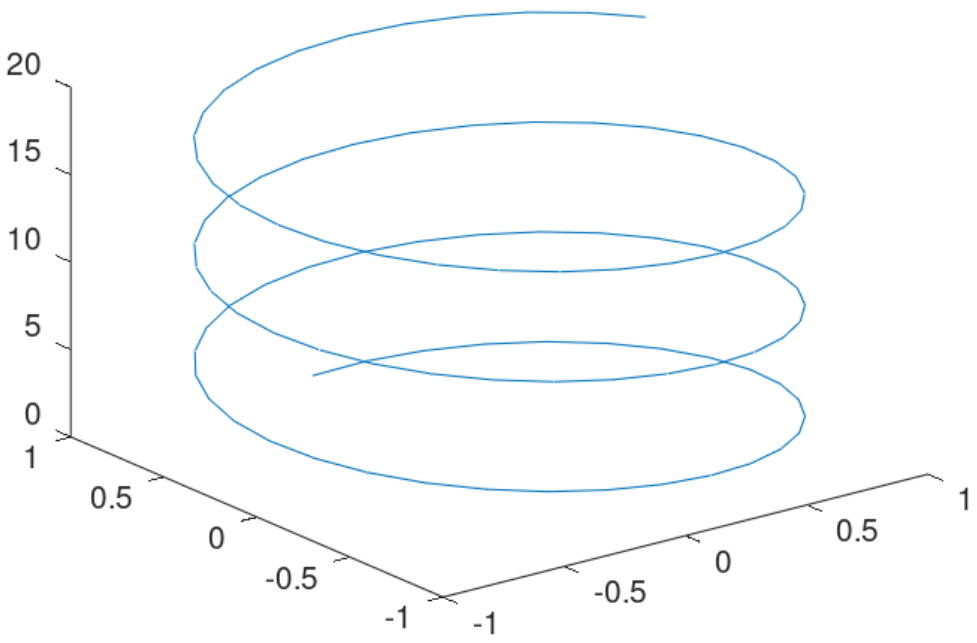
```
x = linspace(0,2*pi,100);
y = sin(x);
plot(x,y); axis('equal');
title('Plot created by Francis'); xlabel('x'); ylabel('y');
pause
plot(x,y,'o'); axis('equal');
pause
plot(x,y,x,y,'o'); axis('equal');
pause;

theta = linspace(0,4*pi,100);
y = exp(-0.4*theta).*sin(theta);
 axis ([-1, 4*pi , -0.5, 10]);
plot(theta,y);
pause;

t = linspace(0,20,100);
x = sin(t); y = cos(t); z = t;
plot3(x,y,z);
pause;

help plot

x = linspace(0,10,1000);
y = x.^3;
semilogx(x,x,x,y);
pause;
```

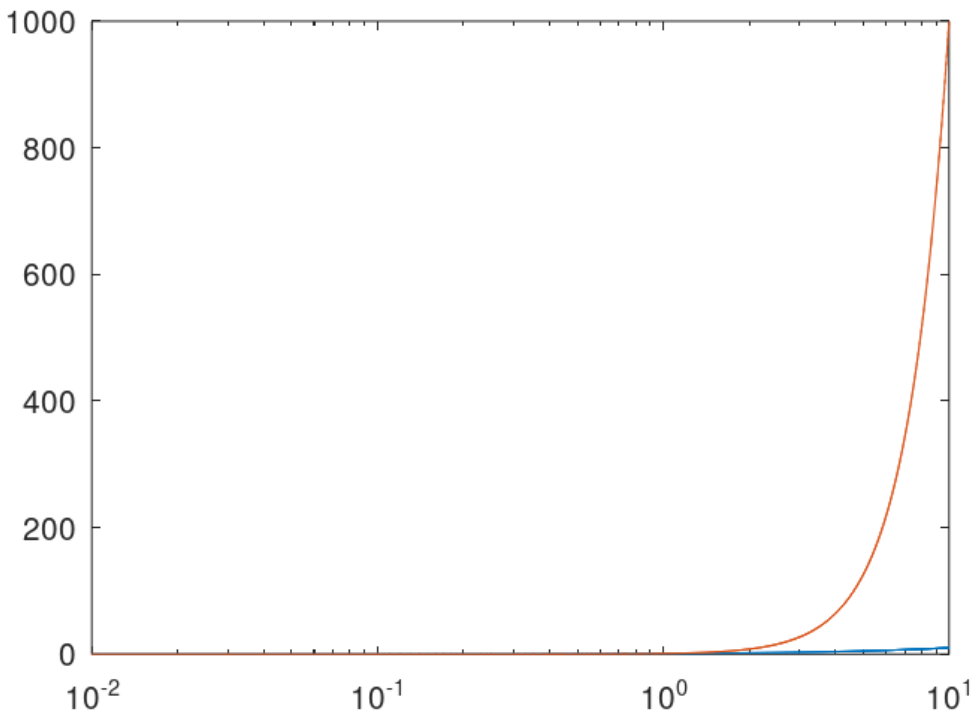
```
x = linspace(0,pi,100);
plot(x,cos(x),x,1-x.^2/2+x.^4/24)
pause
```

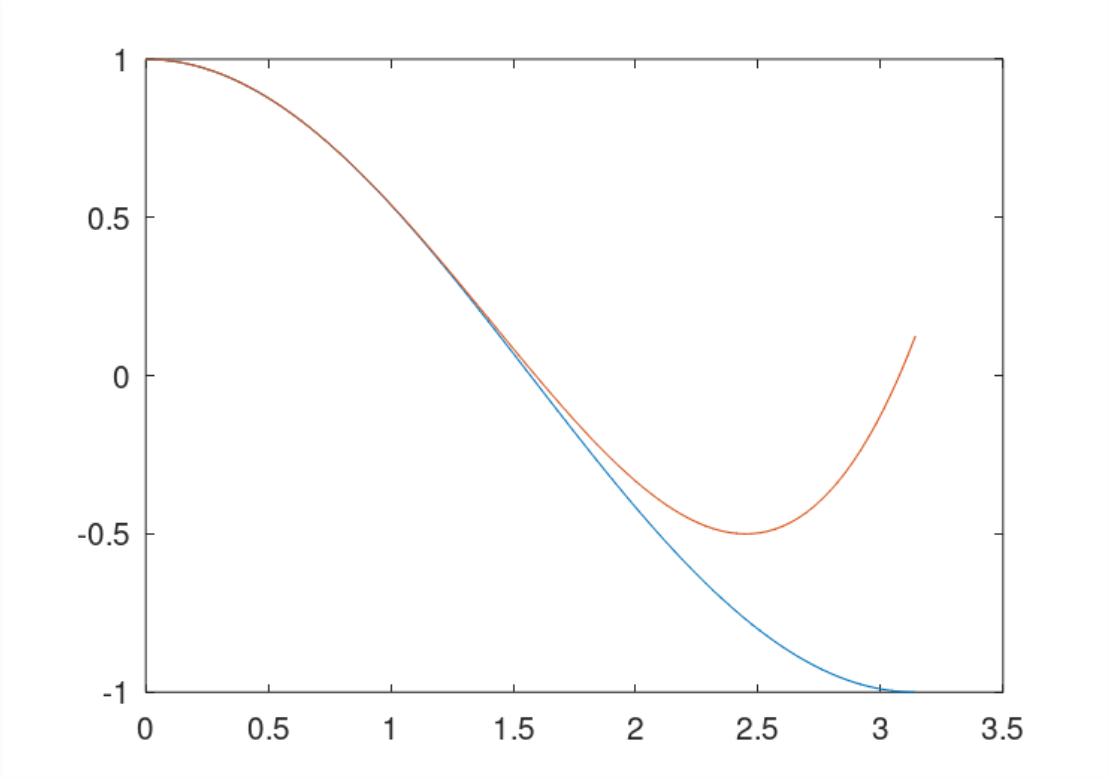
Output

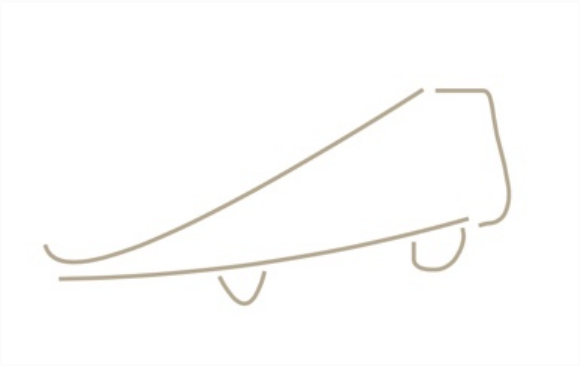


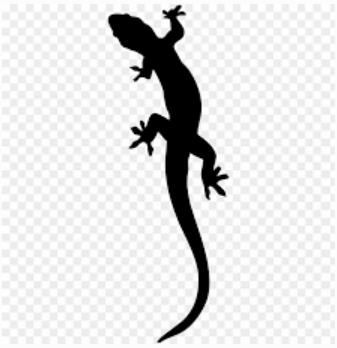



20
15
10
5
0
1
0.5
0
-0.5
-1
-1
-0.5
0
0.5
1


1000
800
600
400
200
0
10^{-2}
10^{-1}
10^{0}
10^{1}







Pg 33 Exercises 2.4 Lesson 4

Commands

```
circle
who
whos
[theta' x' y']
type circle.m
```

```
lookfor unit

strftime ("%r %A %e %B %Y", localtime (time ()))
disp('____ is the cursed teacher.')
```

Output

```
Enter the radius of the circle: 9

Variables visible from the current scope:

ans    r      theta  x      y

Variables visible from the current scope:

variables in scope: top scope

   Attr Name        Size                     Bytes  Class
   ==== ====        ====                     =====  =====
        ans         1x1                          8  double
        r           1x1                          8  double
        theta       1x100                      800  double
        x           1x100                      800  double
        y           1x100                      800  double

Total is 302 elements using 2416 bytes

ans =

         0   9.0000         0
   0.0635   8.9819   0.5708
   0.1269   8.9276   1.1393
   0.1904   8.8374   1.7033
   0.2539   8.7115   2.2603
   0.3173   8.5506   2.8083
   0.3808   8.3553   3.3450
   0.4443   8.1263   3.8682
   0.5077   7.8646   4.3758
   0.5712   7.5713   4.8658
   0.6347   7.2474   5.3362
   0.6981   6.8944   5.7851
   0.7616   6.5136   6.2107
   0.8251   6.1066   6.6113
   0.8885   5.6750   6.9853
   0.9520   5.2205   7.3312
   1.0155   4.7450   7.6475
   1.0789   4.2504   7.9331
   1.1424   3.7387   8.1867
   1.2059   3.2120   8.4073
   1.2693   2.6723   8.5941
   1.3328   2.1218   8.7463
   1.3963   1.5628   8.8633
   1.4597   0.9975   8.9445
   1.5232   0.4282   8.9898
   1.5867  -0.1428   8.9989
   1.6501  -0.7132   8.9717
   1.7136  -1.2808   8.9084
   1.7771  -1.8433   8.8092
```

```
 1.8405  -2.3983   8.6746
 1.9040  -2.9436   8.5050
 1.9675  -3.4771   8.3012
 2.0309  -3.9966   8.0639
 2.0944  -4.5000   7.7942
 2.1579  -4.9853   7.4931
 2.2213  -5.4505   7.1619
 2.2848  -5.8937   6.8017
 2.3483  -6.3133   6.4142
 2.4117  -6.7074   6.0009
 2.4752  -7.0745   5.5634
 2.5387  -7.4131   5.1035
 2.6021  -7.7219   4.6231
 2.6656  -7.9995   4.1240
 2.7291  -8.2450   3.6084
 2.7925  -8.4572   3.0782
 2.8560  -8.6354   2.5356
 2.9195  -8.7789   1.9828
 2.9829  -8.8869   1.4220
 3.0464  -8.9592   0.8555
 3.1099  -8.9955   0.2856
 3.1733  -8.9955  -0.2856
 3.2368  -8.9592  -0.8555
 3.3003  -8.8869  -1.4220
 3.3637  -8.7789  -1.9828
 3.4272  -8.6354  -2.5356
 3.4907  -8.4572  -3.0782
 3.5541  -8.2450  -3.6084
 3.6176  -7.9995  -4.1240
 3.6811  -7.7219  -4.6231
 3.7445  -7.4131  -5.1035
 3.8080  -7.0745  -5.5634
 3.8715  -6.7074  -6.0009
 3.9349  -6.3133  -6.4142
 3.9984  -5.8937  -6.8017
 4.0619  -5.4505  -7.1619
 4.1253  -4.9853  -7.4931
 4.1888  -4.5000  -7.7942
 4.2523  -3.9966  -8.0639
 4.3157  -3.4771  -8.3012
 4.3792  -2.9436  -8.5050
 4.4427  -2.3983  -8.6746
 4.5061  -1.8433  -8.8092
 4.5696  -1.2808  -8.9084
 4.6331  -0.7132  -8.9717
 4.6965  -0.1428  -8.9989
 4.7600   0.4282  -8.9898
 4.8235   0.9975  -8.9445
 4.8869   1.5628  -8.8633
 4.9504   2.1218  -8.7463
 5.0139   2.6723  -8.5941
 5.0773   3.2120  -8.4073
 5.1408   3.7387  -8.1867
 5.2043   4.2504  -7.9331
 5.2677   4.7450  -7.6475
 5.3312   5.2205  -7.3312
 5.3947   5.6750  -6.9853
 5.4581   6.1066  -6.6113
 5.5216   6.5136  -6.2107
```

```
   5.5851   6.8944  -5.7851
   5.6485   7.2474  -5.3362
   5.7120   7.5713  -4.8658
   5.7755   7.8646  -4.3758
   5.8389   8.1263  -3.8682
   5.9024   8.3553  -3.3450
   5.9659   8.5506  -2.8083
   6.0293   8.7115  -2.2603
   6.0928   8.8374  -1.7033
   6.1563   8.9276  -1.1393
   6.2197   8.9819  -0.5708
   6.2832   9.0000  -0.0000

circle.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/circle.m

% CIRCLE - A script file to draw a unit circle
% File written by Rudra Pratap. Last modified 6/28/98
% -------------------------
r = input('Enter the radius of the circle: ');
theta = linspace(0,2*pi,100);   % create vector theta
x = r * cos(theta);                                    % generate x-coordinates
y = r * sin(theta);                                    % generate y-coordinates
plot(x,y);
hold on;
plot(0,0,'x');
axis('equal');
title('Circle of unit radius')
pause
I                   Return a scalar, matrix, or N-dimensional array whose eleme
                    nts are all equal to the pure imaginary unit, defined as
                    ``sqrt (-1)'.
luupdate            Given an LU factorization of a real or complex matrix A = L
                    *U, L lower unit trapezoidal and U upper trapezoidal, retur
                    rn the LU factorization of A + X*Y.
info                Display contact information for the GNU Octave community.
cylinder            Plot a 3-D unit cylinder.
sphere              Plot a 3-D unit sphere.
addtodate           Add Q amount of time (with units F) to the serial datenum,
                    D.
circle              CIRCLE - A script file to draw a unit circle  File written
                    by Rudra Pratap.
ans = 05:39:07 PM Thursday 11 March 2021
____ is the cursed teacher.
```

Bearing

Commands

```
load('assets/bearingdata.mat')
min(data)
bounds(data) # only does lowest
max(data)
mean(data)
median(data)
mode(data)
std(data)
var(data)
```

```
corrcoef(data)
cov(data)
```

Output

```
ans = 2.3601
ans = 2.3601
ans = 2.3650
ans = 2.3623
ans = 2.3623
ans = 2.3601
ans = 1.4878e-03
ans = 2.2135e-06
ans = 1
ans = 2.2135e-06
```

Page 37

Commands

```
help disp
function temp = convert(Ti, Tf)
   C = [Ti: Tf]';
   F = 9/5*C + 32
   temp = [C F];
end
convert(-1, 10)

function output = fact(n)
   output = 1;
   while n > 1
      output *= n;
      n--;
   endwhile
end

fact(4)
fact(9)


function out = crossprod (u, v)
   out = [u(2)*v(3) - u(3)*v(2), u(3)*v(1) - u(1)*v(3), u(1)*v(2) - u(2)*v(1)];
end

crossprod([1,0,0], [0,1,0])
crossprod([0,1,0], [0,0,1])

function out = summer(r, n)
   out = (r^(n+1)-1)/(r-1);
end

summer(0.5, 5)
summer(1/3, 2)


function out = interest(X, n, r, k)
```

```
   out = X * ((1+r/k)^(k*n)-1);
end

format bank
interest(1000,5,.06, 4)
interest(1000,5,.06, 365)
```

Output

```
disp' is a built-in function from the file libinterp/corefcn/pr-output.cc

 -- disp (X)
 -- STR = disp (X)
     Display the value of X.

     For example:

          disp ("The value of pi is:"), disp (pi)

               -| the value of pi is:
               -| 3.1416

     Note that the output from 'disp' always ends with a newline.

     If an output value is requested, 'disp' prints nothing and returns
     the formatted output in a string.

     See also: fdisp.

Additional help for built-in functions and operators is
available in the online version of the manual.  Use the command
'doc <topic>' to search the manual index.

Help and information about Octave is also available on the WWW
at https://www.octave.org and via the help@octave.org
mailing list.
F =

   30.20
   32.00
   33.80
   35.60
   37.40
   39.20
   41.00
   42.80
   44.60
   46.40
   48.20
   50.00

ans =

   -1.00   30.20
       0   32.00
    1.00   33.80
    2.00   35.60
    3.00   37.40
```

```
    4.00   39.20
    5.00   41.00
    6.00   42.80
    7.00   44.60
    8.00   46.40
    9.00   48.20
   10.00   50.00

ans = 24.00
ans = 362880.00
ans =

      0      0   1.00

ans =

   1.00      0      0

ans = 1.97
ans = 1.44
ans = 346.86
ans = 349.83
```

LAB 6

Textbook Problems

Commands

```
disp('pg 45')
A = [1 2 3; 4 5 6; 7 8 8]
A(2,3)
A(3,3) = 9
B = A(2:3, 1:3)
B = A(2:3, :)
B(:,2)=[]

disp('pg 51')
eye(3)
B = [ones(3) zeros(3,2); zeros(2,3) 4*eye(2)]
diag(B)'
diag(B,1)'
d = [2 4 6 8];
d1 = [-3 -3 -3];
d2 = [-1 -1];
D = diag(d) + diag(d1,1) + diag(d2, -2)

disp('pg 55')
A = [1 2 3; 4 5 6; 7 8 9];
x = A(1,:)'
x'*x
x*x'
A*x
A^2
```

```
A.^2

disp('pg 60')
A = [1 2; 3 4];
asqrt = sqrt(A)
Asqrt = sqrtm(A)
exp_aij = exp(A)
exp_A = expm(A)

disp('pg 68')
A = [5 -3 2; -3 8 4; 4 2 -9];
eig(A)
[eigvec, eigval] = eig(A)

disp('pg 72')
x = 0: .1: 20;
y = exp(0.1*x).*sin(x);
plot(x,y)
xlabel('Time (t) in Seconds')
ylabel('The Response Amplitude in mm')
title('A simple 2-D Plot')
print 'assets/resp_amp.eps' -deps

A = [2 6; 3 9]
B = [1 2; 3 4]
C = [-5 5; 5 3]
(A+B)-(B+A)
((A+B)+C)-(A+(B+C))
(5*(A+B))-(5*A+5*B)
A*(B+C) - (A*B + A*C)
A*B-A*C
A*B-B*A

zeros(2,3)
5*eye(3)
3*ones(2)

G = [A zeros(2,4); zeros(2) B zeros(2); zeros(2,4) C]
G(:,6) = []
G(6,:) = []
G(1:4,1:4)
G(5,5) = 4
G(13) # 1 is the 13 element as a flat vector
G(12,1) = 1 # increases size

A = ones(20);
A(6:15,6:15) = zeros(10);
spy(A) # bunch of stars with empty square in middle
A(16:20,1:5) = zeros(5);
A(1:5,16:20) = zeros(5);
spy(A)

A = diag(1:6) + diag(7:11,1) + diag(12:15,2)
A = A + triu(A,1)'

A = rand(10);
A = fix(A*100)
idx = A < 10;
A(idx) = 0;
```

```
idx = A > 90;
A(idx) = inf
idx = (A <= 50 & A >= 30);
b = A(idx)'
```

Output

```
pg 45
A =

   1   2   3
   4   5   6
   7   8   8

ans = 6
A =

   1   2   3
   4   5   6
   7   8   9

B =

   4   5   6
   7   8   9

B =

   4   5   6
   7   8   9

B =

   4   6
   7   9

pg 51
ans =

Diagonal Matrix

   1   0   0
   0   1   0
   0   0   1

B =

   1   1   1   0   0
   1   1   1   0   0
   1   1   1   0   0
   0   0   0   4   0
   0   0   0   0   4

ans =

   1   1   1   4   4
```

```
ans =

   1   1   0   0

D =

   2  -3   0   0
   0   4  -3   0
  -1   0   6  -3
   0  -1   0   8

pg 55
x =

   1
   2
   3

ans = 14
ans =

   1   2   3
   2   4   6
   3   6   9

ans =

   14
   32
   50

ans =

    30    36    42
    66    81    96
   102   126   150

ans =

    1    4    9
   16   25   36
   49   64   81

pg 60
asqrt =

   1.0000   1.4142
   1.7321   2.0000

Asqrt =

   0.5537 + 0.4644i   0.8070 - 0.2124i
   1.2104 - 0.3186i   1.7641 + 0.1458i

exp_aij =

    2.7183    7.3891
   20.0855   54.5982
```

```
exp_A =

    51.969    74.737
   112.105   164.074

pg 68
ans =

  -10.2206
    4.4246
    9.7960

eigvec =

   0.172542   0.870606  -0.537542
   0.238228   0.377390   0.842875
  -0.955760   0.315629  -0.024708

eigval =

Diagonal Matrix

  -10.2206         0         0
         0    4.4246         0
         0         0    9.7960

pg 72
A =

   2   6
   3   9

B =

   1   2
   3   4

C =

  -5   5
   5   3

ans =

   0   0
   0   0

ans =

   0   0
   0   0

ans =

   0   0
   0   0

ans =
```

```
   0   0
   0   0

ans =

   0   0
   0   0

ans =

   12    4
   12  -12

ans =

   0   0   0
   0   0   0

ans =

Diagonal Matrix

   5   0   0
   0   5   0
   0   0   5

ans =

   3   3
   3   3

G =

   2   6   0   0   0   0
   3   9   0   0   0   0
   0   0   1   2   0   0
   0   0   3   4   0   0
   0   0   0   0  -5   5
   0   0   0   0   5   3

G =

   2   6   0   0   0
   3   9   0   0   0
   0   0   1   2   0
   0   0   3   4   0
   0   0   0   0  -5
   0   0   0   0   5

G =

   2   6   0   0   0
   3   9   0   0   0
   0   0   1   2   0
   0   0   3   4   0
   0   0   0   0  -5

ans =
```

```
   2   6   0   0
   3   9   0   0
   0   0   1   2
   0   0   3   4

G =

   2   6   0   0   0
   3   9   0   0   0
   0   0   1   2   0
   0   0   3   4   0
   0   0   0   0   4

ans = 1
G =

   2   6   0   0   0
   3   9   0   0   0
   0   0   1   2   0
   0   0   3   4   0
   0   0   0   0   4
   0   0   0   0   0
   0   0   0   0   0
   0   0   0   0   0
   0   0   0   0   0
   0   0   0   0   0
   1   0   0   0   0

A =

    1    7   12    0    0    0
    0    2    8   13    0    0
    0    0    3    9   14    0
    0    0    0    4   10   15
    0    0    0    0    5   11
    0    0    0    0    0    6

A =

    1    7   12    0    0    0
    7    2    8   13    0    0
   12    8    3    9   14    0
    0   13    9    4   10   15
    0    0   14   10    5   11
    0    0    0   15   11    6

A =

    3    1   43   54   38   70   38   56   20   10
   43    9   98   53   42   10   92   67   39   14
   88   75   22    7   31   41   91   21   83   65
   18   56    8   86   54    4   97    7   27   15
   20   23    6   43   81   55   97   65   83   18
   98   93   76   94   44   99    4   26   65    9
   11   78   43   91   23   92   73   49   27   35
   24   78   26    5   83   85    9   16   86   52
   75   13   56   57   84    9   79   48   34   91
   12   38   62   50   11   22   62   39   42    2
```

```
A =

     0     0    43    54    38    70    38    56    20    10
    43     0   Inf    53    42    10   Inf    67    39    14
    88    75    22     0    31    41   Inf    21    83    65
    18    56     0    86    54     0   Inf     0    27    15
    20    23     0    43    81    55   Inf    65    83    18
   Inf   Inf    76   Inf    44   Inf     0    26    65     0
    11    78    43   Inf    23   Inf    73    49    27    35
    24    78    26     0    83    85     0    16    86    52
    75    13    56    57    84     0    79    48    34   Inf
    12    38    62    50    11    22    62    39    42     0

b =

   43   38   43   43   43   50   38   42   31   44   41   38   49   48   39   39   34   42   35
```

LAB 7

Script File

Commands

```
%------------ This is the script file 'solvex.m' ------------
% It solves equation (4.1) for x and also calculates det(A).

A = [2 2*r r; 3 6 2*r-1; 2 r-1 3*r];
b = [2; 3; 5];
det_A = det(A);
x = A\b;

%------------------------ CLI Commands ------------------------
r = 1;
solvex
```

Output

```
det_A = 10.000
x =

  -0.2000
   0.3000
   1.8000
```

Function File

Commands

```
%------------ This is the script file 'solvex.m' ------------
function [det_A, x] = solvexf(determinant_func, r);
% SOLVEXF solves a 3x3 watrix equation with parameter function
% To call this function, type:
% [det_A,x] = solvexf(determinant_func, r);
% r is the input and det_A and x are output
% ------------------------------------------------------
A = [2 2*r r; 3 6 2*r-1; 2 r-1 3*r];
b = [2; 3; 5];
det_A = feval(determinant_func,A)
x = A\b

%----------------------- CLI Commands -----------------------
[detA, x] = solvexf(@det, 1)
```

Output

```
det_A = 10.000
x =

  -0.2000
   0.3000
   1.8000
```

Profiling

Commands

```
profile on
[detA, x] = solvexf(@det, 1)
profile off
profshow % shows the contents of the current profiling session
```

Output

```
detA = 10.000
x =

  -0.2000
   0.3000
   1.8000

   #            Function Attr     Time (s)    Time (%)        Calls
-----------------------------------------------------------------------
   9             profile             0.000      23.76            1
   1             solvexf             0.000      21.38            1
   7             display             0.000      16.70            2
   8                disp             0.000      12.19            2
   5                 det             0.000      11.84            1
   4               feval             0.000       6.01            1
   6            binary \             0.000       4.06            1
  12               false             0.000       1.50            1
   2            binary *             0.000       0.80            3
  10              nargin             0.000       0.71            1
```

```
  11           binary !=             0.000       0.71            1
   3            binary -             0.000       0.35            2
  13 __profiler_enable__             0.000       0.00            1
```

Global Variables

Commands

```
%----------------------- Script File -----------------------
global k_value c_value;

function xdot = ode1(t,x);
% ODE1: function to compute the derivative xdot
global k_value c_value
xdot = k_value * x + c_value * sin(t);
end

k_value = 5; c_value = 2;
ts = [0 20];
x0 = 1.0;
[t, x] = ode23('ode1', ts, x0)
[t(1:10), x(1:10)]
```

Output

```
ans =

         0   1.0000
    0.0178   1.0933
    0.0445   1.2510
    0.0845   1.5337
    0.1330   1.9662
    0.1841   2.5561
    0.2359   3.3370
    0.2881   4.3618
    0.3405   5.7031
    0.3930   7.4565
```

While loops

Commands

```
v = 1; i = 1; num = 0;
while num < 10000
   num = 2^i;
   v = [v; num];
   i = i + 1;
end
v
```

Output

```
v =

       1
       2
       4
       8
      16
      32
      64
     128
     256
     512
    1024
    2048
    4096
    8192
   16384
```

Switch, if, keyboard

Commands

```
%------------- This is the script file 'work.m' -------------
A = ones(10)
for i = 1:10
   disp(i)
   if i == 5
      keyboard
   elseif i==4
      for j=1:10
         switch mod(A(3,j),2)
            case 0
               A(4,j) = 1;
            case 1
               A (4,j) = -2;
         end
      end
   end
   A(:,i) = i*A(:,i);
end
%----------------------- CLI Commands -----------------------
work
keyboard> A
keyboard> return
A
```

Output

```
octave:45>work
A =

   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1
```

```
   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1
   1   1   1   1   1   1   1   1   1   1

1
2
3
4
5
stopped in solvexf at line 5 [~/octave/solvexf.m]
5:              keyboard
keyboard> A
A =

   1   2   3   4   1   1   1   1   1   1
   1   2   3   4   1   1   1   1   1   1
   1   2   3   4   1   1   1   1   1   1
  -2   1  -2  -8  -2  -2  -2  -2  -2  -2
   1   2   3   4   1   1   1   1   1   1
   1   2   3   4   1   1   1   1   1   1
   1   2   3   4   1   1   1   1   1   1
   1   2   3   4   1   1   1   1   1   1
   1   2   3   4   1   1   1   1   1   1
   1   2   3   4   1   1   1   1   1   1

keyboard> return
6
7
8
9
10
octave:46> A
A =

    1    2    3    4    5    6    7    8    9   10
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4    5    6    7    8    9   10
   -2    1   -2   -8  -10  -12  -14  -16  -18  -20
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4    5    6    7    8    9   10
```

Demonstration Script

Commands

```
function [det_A, x] = solvexf(determinant_func);
   % SOLVEXF solves a 3x3 watrix equation with parameter function
   r = input('r: ');
   A = [5 2*r r; 3 6 2*r-1; 2 r-1 3*r]
   b = [2;3;5];
```

```
   det_A = feval(determinant_func,det(A)) % uses a user defined function to compute determinant
   x = A\b;
   gain_control = input('Would you like to gain control? (y/n) ','s');
   switch gain_control
      case 'y'
         disp('Type "return" and hit RETURN to continue.');
         keyboard;
      case 'n'
         choice = menu('What would you like to do now?','Sleep','print ''x''');
         switch choice
            case 1
               disp('Goodnight')
               exit
            case 2
               x
               disp('.')
               pause(1)
               disp('.')
               pause(1)
               disp('.')
               pause(1)
               disp('GO SLEEP')
               exit
            end
      otherwise
         error('Invalid Choice');
   end
   disp('Continuing')
   FallSem(1).course = 'cs101';
   FallSem(1).prof = 'turing';
   FallSem(1).score = [80 75 95];
   FallSem
   FallSem(2).course = 'phy200';
   FallSem(2).prof = 'Fiegenbaum';
   FallSem(2).score = [72 75 78];
   FallSem
   FallSem(2).course
   container = cell(2,2);
   container{1,1} = FallSem(1);
   container{2,1} = FallSem(2);
   container{1,2} = 2;
   container{2,2} = 'a';
   container
end

solvexf('det');
```

Output

```
Started execution
r: 1
A =

   5   2   1
   3   6   1
   2   0   3

det_A = 64
```

```
Would you like to gain control? (y/n) y
Type "return" and hit RETURN to continue.
stopped in solvexf at line 14 [/Users/francischua/gitprojects/octave/work.m]
14:          keyboard;
keyboard> r
r = 1
keyboard> return
Continuing
FallSem =

  scalar structure containing the fields:

    course = cs101
    prof = turing
    score =

       80   75   95


FallSem =

  1x2 struct array containing the fields:

    course
    prof
    score

ans = phy200
container =
{
  [1,1] =

    scalar structure containing the fields:

      course = cs101
      prof = turing
      score =

         80   75   95


  [2,1] =

    scalar structure containing the fields:

      course = phy200
      prof = Fiegenbaum
      score =

         72   75   78


  [1,2] = 2
  [2,2] = a
}
```

LAB 8

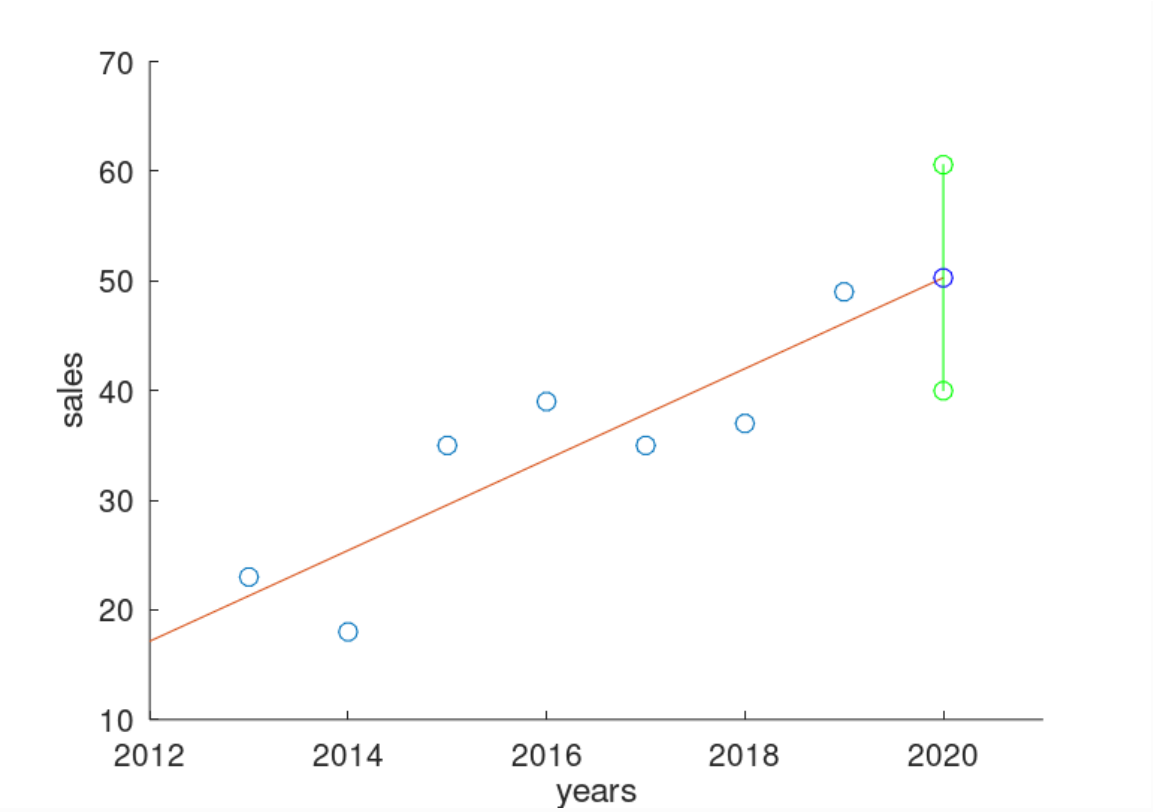
Linear Regression

Commands

```
type forecasting_data.txt;
data = load("-ascii", "forecasting_data.txt");
n = size(data)(1)
AVG = mean(data)
SUM_SQUARE = var(data(:,1))*(n-1)
COV_N = sum((data(:,1) - AVG(1)) .* (data(:,2) - AVG(2)))
b = COV_N / SUM_SQUARE
a = AVG(2) - b * AVG(1)
epsilon = std(data(:,2))
% epsilon = sqrt(sum((data(:,2) - AVG(2)).^2)/(n-1)). This gives a different number from shown.
disp('68% confidence. r not calculated')
Y_low = a + b*2020 - epsilon
Y_high = a + b*2020 + epsilon
hold on
scatter(data(:,1),data(:,2),'o')
plot([2012 2020],[2012*b + a, 2020*b + a])
plot([2020 2020], [Y_low, Y_high], 'go-')
plot([2020], [a + b*2020], 'bo')
hold off
xlabel('years')
xlabel('sales')
axis([2012,2021,10,70])
pause
```

Output

```
2013    23
2014    18
2015    35
2016    39
2017    35
2018    37
2019    49
n = 7
AVG =

   2016.000     33.714

SUM_SQUARE = 28
COV_N = 116
b = 4.1429
a = -8318.3
epsilon = 10.307
68% confidence. r not calcualted
Y_low = 39.979
Y_high = 60.593
```



LAB 10

Data Manipulation

Commands

```
# load data from bearingdata.mat
load('assets/bearingdata.mat')
# show the first few values of the data
data(1:5)
# perform transformation
data_grams = data * 28.35;
# show last few values of transformed data
data_grams(96:100)
# save the new data to a file
save('assets/bearing data_grams','data_grams')
# show the median of new data
median(data_grams)
# find the smallest and largest elements of the new data
[smallest,largest] = bounds(data_grams)
# show the use of format long
format long
ounce = 0.0283495;
data_kilograms = data * ounce;
data_kilograms(96:100)
```

Output

```
ans =

   2.364942089643925
   2.362699910495190
   2.363534587096614
   2.364997458100488
   2.361439246724076

ans =

   66.99682176558042
   66.95260941494178
   66.99867785420295
   67.01218938489492
   66.98866657743373

ans = 66.97214821453088
smallest = 66.90746521565018
largest = 67.04767793714885
ans =

   6.699564016378561e-02
   6.695142859290623e-02
   6.699749621967289e-02
   6.701100751206626e-02
   6.698748511946939e-02
```

Script Files

Commands

```
# show and execute velocity.m
type velocity.m
velocity
# show and execute mars_velocity.m
type mars_velocity.m
mars_velocity
# show and execute rating_to_pound.m
type rating_to_pound.m
rating_to_pound
```

Output

```
velocity.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/velocity

# --- VELOCITY.M FILE --- #
dia = 2.5;
gravity = 981
%A = cross-sectional area or pi*((d/2)^2)  Note:  d/2 gives radius
area = pi*((dia/2)^2);
%m = mass of the falling object
mass = 65.4710;
%p = density (air = 1.225 kg/m^3) or .001225 gare/m^3
airDensity =0.001225;
```

```
%C = drag coefficient for  sphere is 0.47
C=0.47
% Vt = √(2mg)/(ρCA)
Vt = sqrt((2*mass*gravity)/(airDensity*C*area))
# --- VELOCITY.M FILE --- #
gravity = 981
C = 0.470000000000000
Vt = 6741.741030699041
mars_velocity.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/mars

# --- MARS_VELOCITY.M FILE --- #
dia = .025;
gravity = 3.711;
area = pi*((dia/2)^2);
mass=65.4710;
airDensity = 20.;
C=0.47;
Vt=sqrt((2*mass*gravity)/(airDensity*C*area))
# --- MARS_VELOCITY.M FILE --- #
Vt = 324.5159789486731
rating_to_pound.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/ra

# --- RATING_TO_POUND.M --- #
lbf=224.809;
open = 6;
closed = 20;
openlbf = open * lbf;
closed =closed * lbf
# --- RATING_TO_POUND.M --- #
closed = 4496.180000000000
```

Miscellaneous Commands

Commands

```
# show int8 bounds (2^7 = 128)
x = int8(120) + int8(50)
# usage of fix
x = fix(3.4) + rem(5,2)
# usage of ceil
x = ceil(3.4) + rem(5,2)
# manipulate character array
st = '12345';
st(1)=72; st(2)=69; st(3)=76; st(4)=76; st(5)=79
# show string comparison
text1 = 'Four score';
text2 = '87 years ago';
text3 = 'Four score';
strcmp(text1, text2)
strcmp(text1, text3)
# strfind
text1 = 'Four score and seven years ago';
index = strfind(text1, 'seven')
# failing to add different integer types
% sum2=int16(5) + int8(3)
# load the io package and then the xlsx
pkg load io
```

```
A = xlsread('assets/ChromeExport2.xlsx');
A(1:5,:)
# logical operators
x = 1;
y = 5;
z = ~(x<y)||~(y <x) && islogical(x)
# typecast to unsigned int
x = 55 + uint32(-22) + pi
x = int8(ceil(rem(-528.6,200)))
# random integers, shows a 3d matrix
A = randi(15,4,5,2)
```

Output

```
x = 127
x = 4
x = 5
st = HELLO
ans = 0
ans = 1
index = 16
ans =

         22   16050075        NaN        NaN        NaN        100
         22   16050115        NaN        NaN        NaN        100
         22   16050213        NaN        NaN        NaN        100
         22   16050319        NaN        NaN        NaN        100
         22   16050527        NaN        NaN        NaN        100

z = 0
x = 58
x = -128
A =

ans(:,:,1) =

    2    8    2   12    6
    3   14   12   14   12
   13   15   15   15   12
    8   10    7    7   12

ans(:,:,2) =

    8    3    2   15    5
    6   11    9   13    5
   13    1    6   13    8
   10    1   11   15   15
```

Classes

Commands

```
aScalar = int16(345);
string1 = 'To be or not to be';
aVector = int8(1:5);
aArray = [3,3];
```

```
class(aScalar)
class(string1)
class(aVector)
class(aArray)
```

Output

```
ans = int16
ans = char
ans = int8
ans = double
```

Sizes

Commands

```
aScalar = int16(345);
string1 = 'To be or not to be';
aVector = int8(1:3);
aArray1 = randi(2,3);
aArray2 = [2,3];

size(aScalar)
size(string1)
size(aVector)
size(aArray1)
size(aArray2)
```

Output

```
ans =

   1   1

ans =

    1   18

ans =

   1   3

ans =

   3   3

ans =

   1   2
```

Sparse Cell

Commands

```
b = cell(4,5);
b{1,1} = 'Good Morning';
b{1,2} = 'Bonjour';
b{3,4} = cos(45);
b{4,1} = int16(432);
b
```

Output

```
b =
{
  [1,1] = Good Morning
  [2,1] = [](0x0)
  [3,1] = [](0x0)
  [4,1] = 432
  [1,2] = Bonjour
  [2,2] = [](0x0)
  [3,2] = [](0x0)
  [4,2] = [](0x0)
  [1,3] = [](0x0)
  [2,3] = [](0x0)
  [3,3] = [](0x0)
  [4,3] = [](0x0)
  [1,4] = [](0x0)
  [2,4] = [](0x0)
  [3,4] = 0.525321988817730
  [4,4] = [](0x0)
  [1,5] = [](0x0)
  [2,5] = [](0x0)
  [3,5] = [](0x0)
  [4,5] = [](0x0)
}
```

Arbitrary Fields

Commands

```
rocket.manufacturer = 'SpaceX'
```

Output

```
rocket =

  scalar structure containing the fields:

    manufacturer = SpaceX
```

Extract Every Other

Commands

```
A1 = randi(8,8)
A2 = A1(2:2:8,2:2:8)
```

Output

```
A1 =

   5   5   6   4   8   6   4   2
   4   2   7   8   4   6   6   3
   8   7   5   1   6   3   5   1
   5   4   4   5   4   5   1   8
   1   5   6   4   4   3   8   7
   8   6   4   2   7   2   1   4
   5   8   5   4   8   6   6   6
   5   6   2   1   8   3   7   2

A2 =

   2   8   6   3
   4   5   5   8
   6   2   2   4
   6   1   3   2
```

Matrix Generating

Commands

```
randi(2,3)
randi(2,2,3)
magic(3)
A = magic(4)
for i = 1:4
   row = sum(A(i,:))
endfor
for i = 1:4
   col = sum(A(:,i))
endfor
diagonal = A(1,1) + A(2,2) + A(3,3) + A(4,4)
diagonal = A(1,4) + A(2,3) + A(3,2) + A(4,1)
```

Output

```
ans =

   2   1   1
   1   1   1
   2   2   1

ans =

   2   1   1
   2   1   2

ans =
```

```
   8   1   6
   3   5   7
   4   9   2

A =

   16    2    3   13
    5   11   10    8
    9    7    6   12
    4   14   15    1

row = 34
row = 34
row = 34
row = 34
col = 34
col = 34
col = 34
col = 34
diagonal = 34
diagonal = 34
```

Tables

Commands

Octave does not currently support Tables.

Output

LAB 11

Loops

Commands

```
x = 0;
while x<6
   x = x + 1;
   fprintf('x = %d\n',x);
endwhile
for x = 1:10
   if x == 6
      break;
   endif
   disp(x);
endfor
```

Output

```
x = 1
x = 2
x = 3
x = 4
x = 5
x = 6
1
2
3
4
5
```

Conditionals

Commands

```
octave_version = 6; os = 'mac';
if x < 3
   disp('Get an ugrade')
else
   switch os
      case 'mac'
         disp('brew install octave')
      case 'windows'
         printf('Why do astronauts use Linux?\nBecause they can''t open Windows in space.\n');
      case 'linux'
         disp('"People assume that time is a strict progression of cause to effect but, actually, fr
   end
endif
```

Output

```
brew install octave
```

Image

Commands

```
imageFile = './assets/pretty.png';
ImageMap = imread(imageFile);
rows = size(ImageMap,1);
columns = size(ImageMap,2);
if (rows > 0 && columns > 0)
   y = 1;
while y <= rows
   for x = 1:columns
      for i = 1:3
         ImageMap(y, x, i) = 255 - ImageMap(y, x, i); end
      end
      y = y + 1;
   end
   imwrite(ImageMap, imageFile);
end
```

Output

LAB 12

The Great Bike Race

Commands

```
x = 0:20;
y = 2/7*x +6;
z = 3/5 * x + 2;
hold on;
plot(x,x,'b',x,y,'g',x,z,'r')
plot(42/5,42/5, 'go');
plot((6-2)/(3/5-2/7),(6-2)/(3/5-2/7)*2/7+6, 'go');
plot(5,5, 'ro');
hold off;
text (0,0,"Jill overtakes Elizabeth", "position", [4 9 0]);
text (0,0,"Kim overtakes Elizabeth", "position", [13 9 0]);
text (0,0,"Jill overtakes Kim", "position", [5.5 5 0]);
title ('The Great Bike Race');
xlabel('seconds'); ylabel('distance in meters');
```

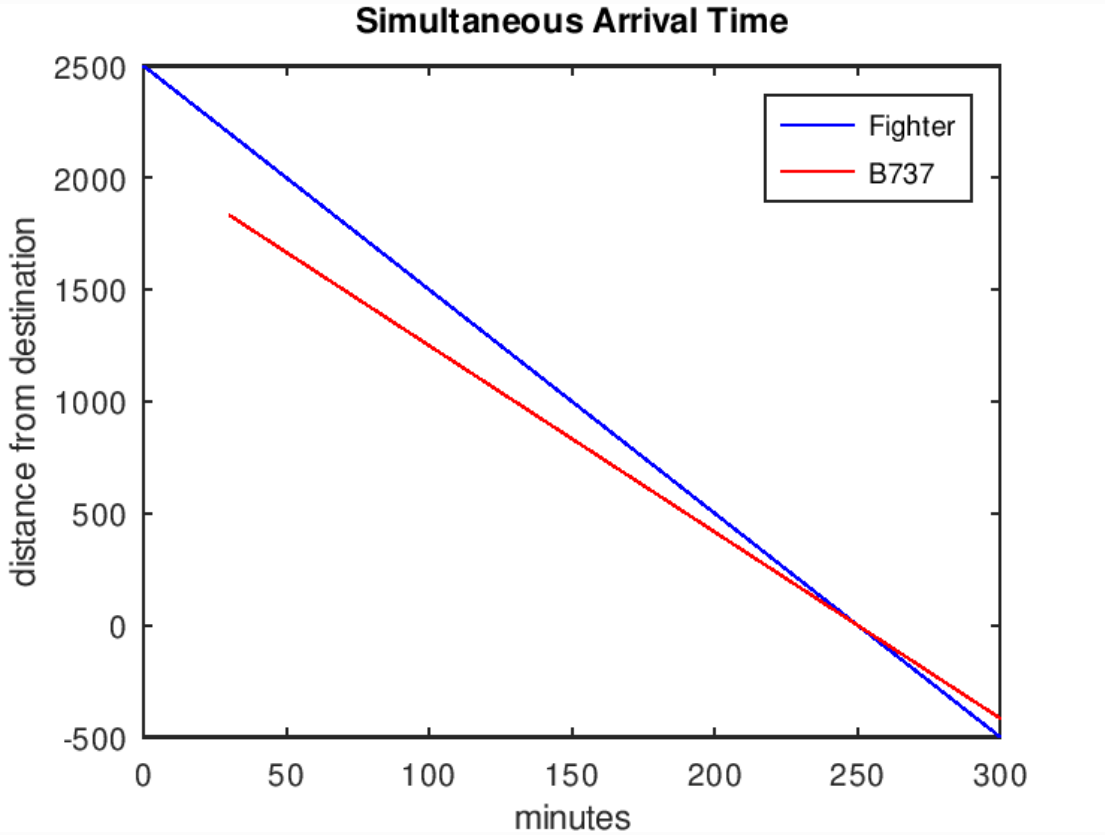
Output

Simultaneous Arrival Plot

Commands

```
x_fighter = 0:10:300;
x_b7 = 30:10:300;
m_fighter = -600/60;
b_fighter = 2500;
minutes_taken_fighter = b_fighter / (-m_fighter);
minutes_taken_b7 = minutes_taken_fighter - 30;
m_b7 = -500/60;
b_b7 = - minutes_taken_b7 * m_b7;

y_fighter = x_fighter * m_fighter + b_fighter;
y_b7 = (x_b7 - 30) * m_b7 + b_b7;

plot(x_fighter,y_fighter,'b',x_b7,y_b7,'r')
title ('Simultaneous Arrival Time');
xlabel('minutes'); ylabel('distance from destination');
legend ("Fighter", "B737");
```

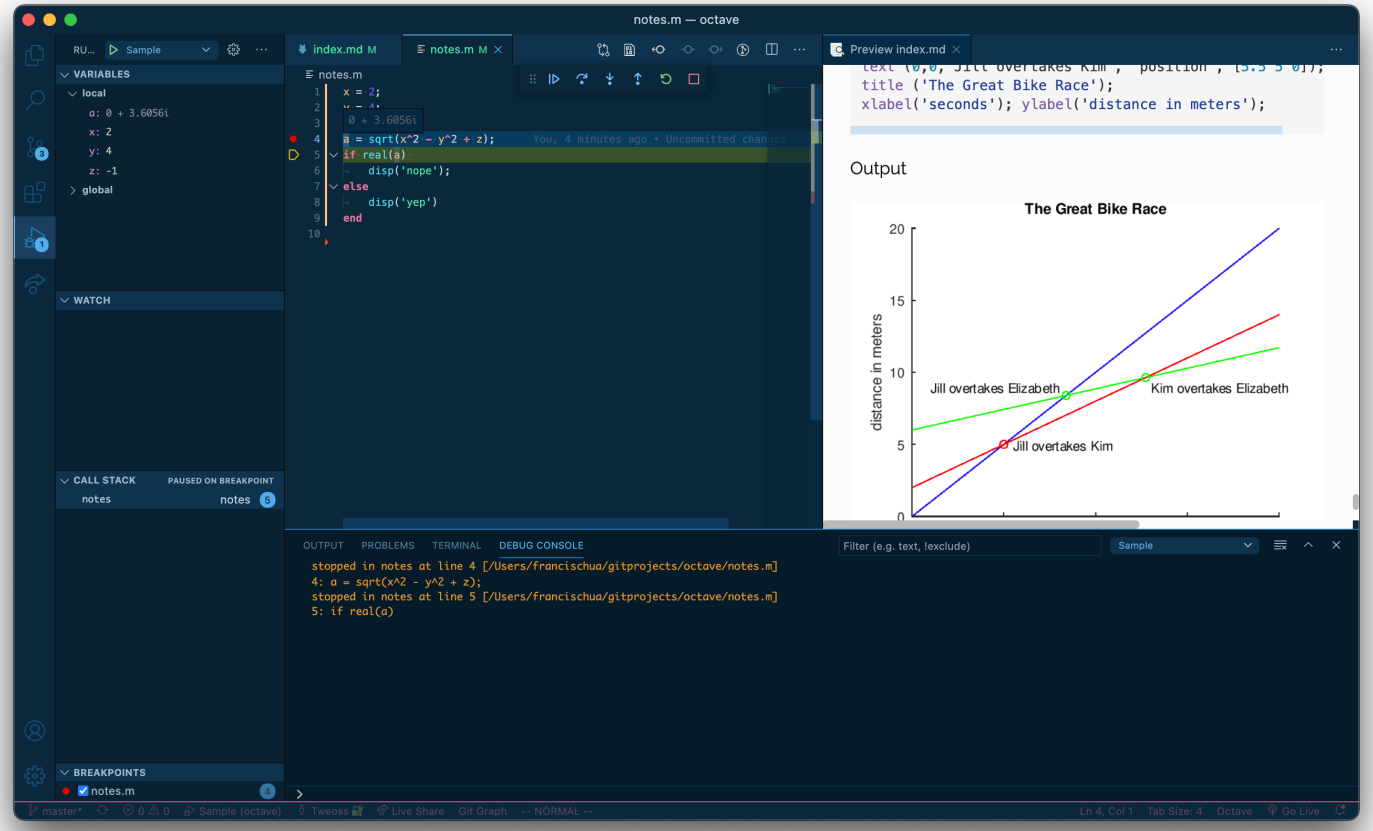
Output



LAB EXTRA

Extra examples to demonstrate proficiency of skills in the check sheet.

Debugging



File System

Commands

```
x = 1;
ls
mkdir temp_example
cd temp_example
save var_file x
type var_file
ls
cd ..
ls
```

Output

```
MatlabNotesPadded.pdf   index.md              notes.m                quizzes                 velo
assets                  index.pdf             notes.pdf              rating_to_pound.m
index.html              mars_velocity.m       octave-workspace       regex.txt
# Created by Octave 6.1.0, Mon May 03 22:41:06 2021 PDT <francischua@Francis-MBP.local>
# name: x
# type: scalar
1



var_file
```

```
MatlabNotesPadded.pdf   index.md               notes.m                quizzes                temp_
assets                  index.pdf              notes.pdf              rating_to_pound.m      veloc
index.html              mars_velocity.m        octave-workspace       regex.txt
```

Geometric Sum

Commands

```
output_precision (10)
r = input('Ratio = ');
first_element = input('First Element = ');
approximation = 0;
for i = 0:10
  approximation += r^i * first_element;
endfor
approximation

exact = first_element / (1 - r)
```

Output

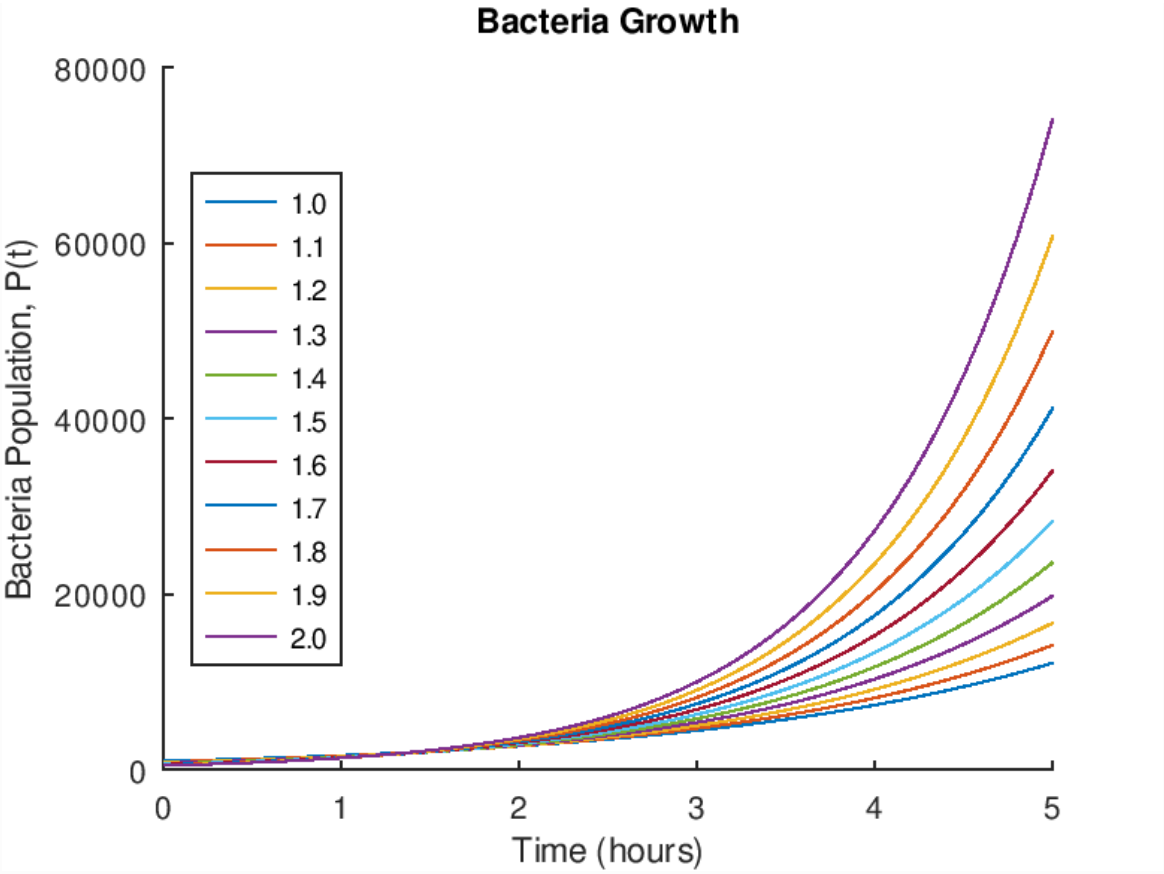
```
Ratio = 0.523
First Element = 6
approximation = 12.56854352
exact = 12.578616350
```

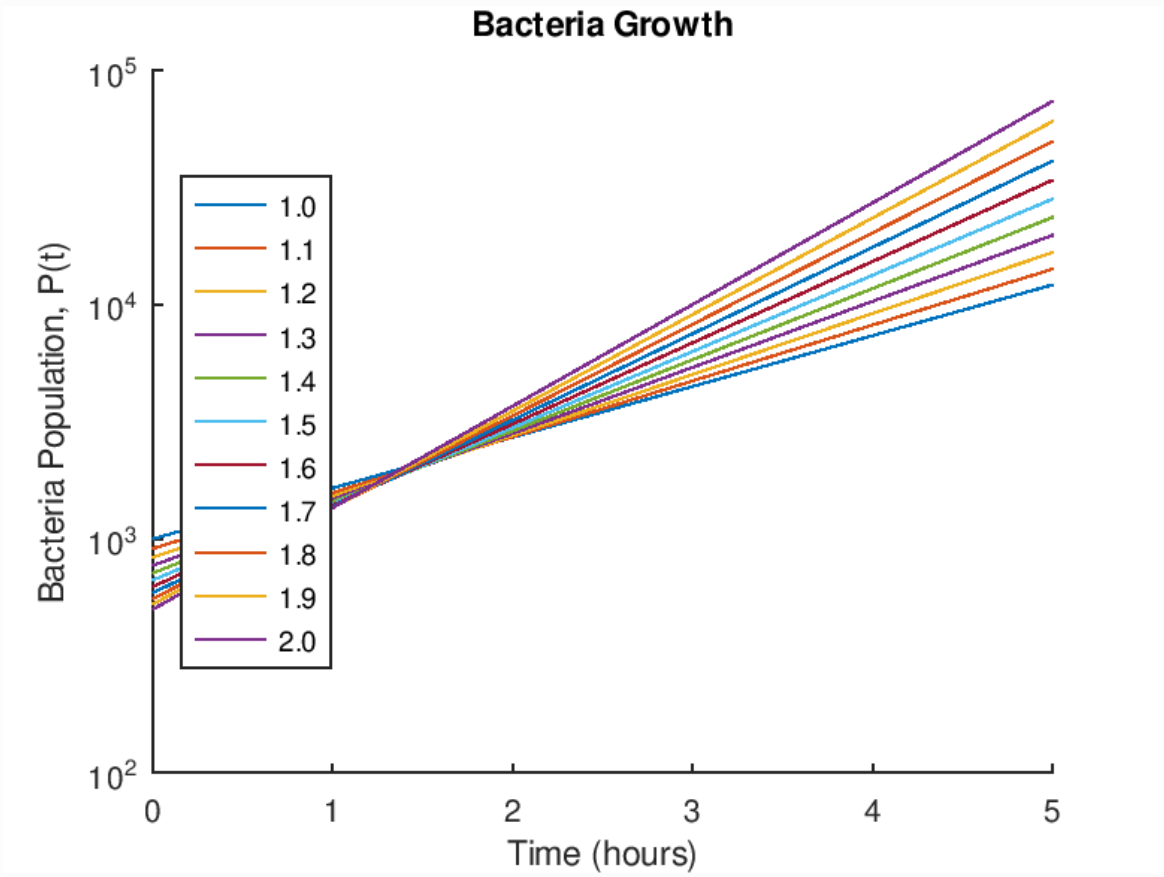
Bacteria Outbreak

Commands

```
x = 0:0.1:5;
title ('Bacteria Growth');
xlabel('Time (hours)'); ylabel('Bacteria Population, P(t)');
hold on;
for a = 1:0.1:2
  plot(x, 1000/a*exp(.5*a*x))
end
legend ("1.0", "1.1", "1.2", "1.3", "1.4", "1.5", "1.6", "1.7", "1.8", "1.9", "2.0", "location", "wes
hold off;

pause

clf
title ('Bacteria Growth');
xlabel('Time (hours)'); ylabel('Bacteria Population, P(t)');
hold on;
for a = 1:0.1:2
  semilogy(x, 1000/a*exp(.5*a*x))
end
legend ("1.0", "1.1", "1.2", "1.3", "1.4", "1.5", "1.6", "1.7", "1.8", "1.9", "2.0", "location", "wes
hold off;
```

Output





Symbolic Math

The symbolic package for Octave must be installed.

Commands

```
pkg load symbolic
syms x y
x =  y + 3
cos(x + 2*ei(2*y))


clear
syms x
f = cos(x) + 2/log(x)
F = int(f, x)
# li is the logarithmic integral
```

Output

```
x = (sym) y + 3
ans = (sym) cos(y + 2·Ei(2·y) + 3)
f = (sym)

             2
  cos(x) + ──────
           log(x)

F = (sym) sin(x) + 2·li(x)
```